REMARKS

Claims 1-6 and 25-39 are presently pending in this application. Claims 1-6 have been amended to more particularly define the invention. Non-elected claims 7-24 have been canceled, reserving the right to submit them in a divisional application. Claims 25-39 have been added to assure Applicants the degree of protection to which their invention entitles them.

It is noted that the claim amendments are made only to assure grammatical and idiomatic English and improved form under United States practice, and are not made to distinguish the invention over the prior art or narrow the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 1-4 were rejected under 35 U.S.C. §103(a) as being unpatentable over Murouchi et al., JP No. 10-186374, in view of Ishihara et al., U.S. Patent No. 6,522,379. Claims 1-4 were also rejected under 35 U.S.C. §103(a) as being unpatentable over Ishikawa et al., U.S. Patent No. 6,414,733, in view of Ishihara et al. Claims 1-4 were additionally rejected under 35 U.S.C. §103(a) as being unpatentable over Shibahara, JP No. 2000-305089, in view of Ishihara et al. Claim 5 was rejected under 35 U.S.C. §103(a) as being unpatentable over Tamatani et al., U.S. Patent Publication No. 2001/0052959, in view of Shibahara. Claim 6 was rejected under 35 U.S.C. §103(a) as being unpatentable over Tamatani, in view of Shibahara, and further in view of Lien, U.S. Patent No. 5,907,380. Claim 5 was also rejected under 35 U.S.C. §103(a) as being unpatentable over Tamatani et al., in view of Murouchi et

al. Claim 6 was also rejected under 35 U.S.C. §103(a) as being unpatentable over Tamatani, in view of Murouchi and further in view of Lien.

These rejections are respectfully traversed.

THE CLAIMED INVENTION

The claimed invention is directed to a liquid crystal display device. An exemplary embodiment includes a color filter substrate, a thin film transistor substrate, and liquid crystals in a gap between the substrates, with a plurality of unit pixels arranged in rows and columns. Columnar spacers are positioned between the color filter substrate and the thin film transistor substrate. The columnar spacers are provided in pairs, with each pair being in a pair of two unit pixels which are adjacent each other in a row or in a column. Each pair of columnar spacers is spaced from all other pairs of columnar spacers by at least two pixels of a row or a column. Such devices are depicted, particularly, in Figures 5-8 of the drawings.

In one exemplary embodiment, the unit pixels are arranged in sets of unit pixels. In a preferred embodiment, each set includes a pixel of a first color, a pixel of a second color, and a pixel of a third color

In a second preferred embodiment, the unit pixels of each pair bear charges that are opposite in polarity.

In another preferred embodiment, the columnar area ratio is within the range of 0.05% to 0.15%.

THE PRIOR ART REFERENCES

The Murouchi, et al. Reference

Murouchi discloses a liquid crystal display device having a substrate 8 and a substrate 10 providing a matrix of unit pixels, with a plurality of columnar spacers 5 between the substrates 8 and 10. In Figure 1, a columnar spacer 5 is provided in every other pixel in each row and every other pixel in each column. In Figure 4, a columnar spacer 5 is provided in every red pixel of a first row, every green pixel of a second row, and every blue pixel of a third row. In Figure 6, a columnar spacer 5 is provided in every red pixel and every green pixel. In Figure 8, a columnar spacer 5 is provided in every green pixel.

There is no showing or suggestion of the columnar spacers being provided in pairs, with each pair being in a pair of two unit pixels which are adjacent each other in a row or in a column, and with each pair of columnar spacers being spaced from all other pairs of columnar spacers by at least two pixels of a row or a column.

The Ishihara, et al. Reference

Ishihara discloses a liquid crystal display element including a color film substrate 201 and a thin film transistor substrate 202, with a liquid crystal layer 4 between them. A complex column spacer 203 is provided for each pixel.

There is no showing or suggestion of the columnar spacers being provided in pairs, with each pair being in a pair of two unit pixels which are adjacent each other in a row or in a column, and with each pair of columnar spacers being spaced from all other pairs of columnar spacers by at least two pixels of a row or a column.

The Ishikawa, et al. Reference

Ishikawa discloses a color liquid crystal display including a color filter substrate 2, a counter electrode substrate 3, and a liquid crystal layer 5. Columnar convex portions 18 maintain the gap between the substrates. Figures 3, 4, 6E and 7D show columnar convex portions 18 at each set of three unit pixels.

There is no showing or suggestion of the columnar spacers being provided in pairs, with each pair being in a pair of two unit pixels which are adjacent each other in a row or in a column, and with each pair of columnar spacers being spaced from all other pairs of columnar spacers by at least two pixels of a row or a column.

The Shibahara Reference

Shibahara discloses a liquid crystal display device with an array of unit pixels. A columnar spacer 24 is provided for each green pixel of the array.

There is no showing or suggestion of the columnar spacers being provided in pairs, with each pair being in a pair of two unit pixels which are adjacent each other in a row or in a column, and with each pair of columnar spacers being spaced from all other pairs of columnar spacers by at least two pixels of a row or a column.

The Tamatani, et al. Reference

Tamatani discloses a liquid crystal display device including a thin film transistor substrate 11 and a color filter substrate 12. A columnar spacer 23 is provided for each set of three unit pixels in the embodiments of Figures 2 and 7. The embodiment of Figure 8 has

two spacers 23 for each set of three unit pixels.

There is no showing or suggestion of the columnar spacers being provided in pairs, with each pair being in a pair of two unit pixels which are adjacent each other in a row or in a column, and with each pair of columnar spacers being spaced from all other pairs of columnar spacers by at least two pixels of a row or a column.

The Lien Reference

Lien discloses a liquid crystal cell and proposes various driving schemes.

There is no showing or suggestion of the columnar spacers being provided in pairs, with each pair being in a pair of two unit pixels which are adjacent each other in a row or in a column, and with each pair of columnar spacers being spaced from all other pairs of columnar spacers by at least two pixels of a row or a column.

ARGUMENT

In each of independent claims 1, 5, and 39, and thus also in each dependent claim 2-4 and 25-38, columnar spacers are provided in pairs, with each pair being in a pair of two unit pixels which are adjacent each other in a row or in a column, and with each pair of columnar spacers being spaced from all other pairs of columnar spacers by at least two pixels of a row or a column.

This configuration provides a liquid crystal display device that avoids the adjacent unit pixels of the same color being driven by signal charges of the same polarity, which would cause a disturbance in the transverse electric field, as discussed on pages 8 and 9 of the

specification. Provision of columnar spacers in the claimed manner is neither shown nor suggested by the references, whether the references be considered one at a time or in combination. It is accordingly urged that the claims distinguish patentably from the references and are allowable.

FORMAL MATTERS

The Office Action objected to the term "column density" in claim 1. This term is defined in the specification at page 5, line 24 to page 6, line 13. Thus, it is submitted that this objection was inappropriate. Nevertheless, in the interest of expediting prosecution, claim 1 has been amended to avoid the term.

The Abstract has been amended to better conform to United States practice.

CONCLUSION

In view of the foregoing, Applicant submits that claims 1-6 and 25-39, all the claims presently pending in the application, are patentably distinct over the prior art of record and that the application is in condition for allowance. Such action would be appreciated.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned attorney at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

To the extent necessary, Applicant petitions for an extension of time under 37 CFR §1.136. Please charge any shortage in the fees due in connection with the filing of this paper,

including extension of time fees, to Attorney's Deposit Account No. 50-0481 and please credit any excess fees to such deposit account.

Respectfully Submitted,

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